WHAT IS CLAIMED IS:

1. In a synchronous machine, a rotor comprising:

a rotor core;

a super-conducting coil mounted on said rotor core;

a vacuum housing covering at least one of said coil side sections, and

a conductive shield over said vacuum housing and coil side sections.

2 In a rotor as in claim 1 wherein said vacuum housing is a channel housing extending longitudinally along said rotor core.

3. In a rotor as in claim 1 wherein the conductive shield is formed of a copper alloy or aluminum.

4. In a rotor as in claim 1 further comprising a rotor end shaft having a collar and a slot in the collar, wherein the vacuum housing is sealed to the slot and an end section of the coil extends into the slot.

5. In a rotor as in claim 4 further comprising a vacuum around said coil and defined by the vacuum housing and slot in the collar.

6. In a rotor as in claim 1 further comprising a planar surface extending longitudinally across the rotor core, wherein one of said coil side sections is adjacent the planar surface, and said vacuum housing

(straddles the one of said side sections, and the side section is sealed to the planer surface.

7. In a rotor as in claim 1 wherein the vacuum vessel is stainless steel, and the shield is a copper alloy.

8. In a rotor as in claim 1 further comprising a plurality of braces buttressing the vacuum housing and conductive shield.

9. A rotor comprising:

a rotor core having an axis;

an end shaft [note: why just "an" end shaft, i.e. a "single"? Compare with claim 17] extending axially from an end of said core, wherein said end shaft has a slot adjacent the core end;

a super-conducting rotor coil having at least one coil side parallel to the core axis and at least one coil end transverse to said core axis, wherein said coil end extends through said slot in the end shaft;

a vacuum housing over said coil side and seal with said slot to define a vacuum region around said coil.

10. A rotor as in claim 9 further comprising a conductive shield over said coil side.

11. A rotor as in claim 9 wherein said vacuum housing is a channel straddling said coil side and

sealed to said rotor core on both sides of said coil side.

12. A rotor as in claim 11 wherein said vacuum housing comprises side-walls on either side of said coil side, and each side wall is sealed to a surface of the rotor core.

13. A rotor as in claim 12 wherein said surface of the rotor core is slotted to receive said side-walls.

14. A rotor as in claim 12 wherein said surface of said rotor core is planar adjacent said coil side.

15. A rotor as in claim 9 further comprising a plurality of braces adjacent said vacuum housing and attached to said rotor core.

16. A rotor as in claim 15 further comprising an electromagnetic shield (supported by said braces.

17. A rotor comprising:

a rotor core having an axis;

a pair of end shafts extending axially from opposite ends of said core, wherein said end shafts each have a slot adjacent the core end;

a super-conducting rotor coil having at least one coil side section parallel to the core axis and adjacent opposite sides of said core, and said coil having coil end sections transverse to said core axis and adjacent the ends of said core, wherein said coil end

sections each extend through one of said slots in the end shafts;

a vacuum housing over each said coil side sections and having ends each being sealed to one of slots, and

a vacuum region around said coil defined by said the slot in said pair of end shafts and the vacuum housing over each of said coil side sections.

18. A rotor as in claim 17 further comprising a conductive shield over said coil side sections and overlapping with said end shafts.

19. A rotor as in claim 18 wherein said shield is a cylinder around said core.

20. A rotor as in claim 18 wherein said is formed partially by a top portion said vacuum housing.

21. A rotor as in claim 17 where in said shield is an arced strip extending a length of said core and extending only partially around a circumference of said core.

22. A rotor as in claim 21 wherein said arced strip and a second arced strip each cover one of said coil side sections.

23. A rotor as in claim 18 further comprising braces adjacent said vacuum housing, attached to a surface of said rotor core and supporting said shield.

24. A method for providing a vacuum around a super-conducting coil winding on a rotor core of a synchronous machine comprising the steps of:

a. assembling the coil winding and rotor core;

b. attaching end shafts coaxially to said core;

c. straddling a vacuum housing over a side section of the coil winding and sealing the housing to said rotor core, and

d. sealing the vacuum housing to said end shafts to form a vacuum region around said coil winding.

25. A method as in claim 24 further comprising the step of placing a conductive shield over said coil.

26. A method as in claim 24 wherein a slot is formed at each joint between an end shaft, the slot receives an end section of the coil winding and the vacuum housing is sealed to said slot.

27. A method as in claim 24 wherein a cylindrical shield is applied over said rotor core.

28. A method as in claim 24 wherein braces placed adjacent said vacuum housing and said rotor core to support a conductive shield.

29. A method as in claim 24 wherein an arced strip is applied over said coil side section, and said strip extends along said core between said end

shafts, and said strip extends only partially around a circumference of said core.

30. A method as in claim 29 wherein said arced strip and a second arced strip are applied to each cover one of said coil side sections.